5.0 CUMULATIVE IMPACTS

5.1 INTRODUCTION

Cumulative impacts result from the incremental impacts of an action when added to past, present, and reasonably foreseeable future actions regardless of who takes the action. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

The Proposed Action incorporates several Applicant-committed BMPs intended to reduce, minimize, or avoid adverse project-specific and cumulative impacts on the environment (See Section 2.3). Additional resource-specific mitigation that would further reduce adverse impacts have been recommended in Chapter 4. In addition, site-specific environmental considerations would likely be identified during the on-site process once locations and ROWs been staked and prior to any surface disturbance. This cumulative analysis assumes the unavoidable adverse impacts after application of the possible mitigating measures.

This chapter discusses cumulative impacts as the incremental effect to specific resources or issues that would occur from the Proposed Action or No Action alternative in conjunction with other cumulative actions. In support of the cumulative impact discussion, this chapter provides discussion on past and present oil and gas activities in the Uinta Basin, both of which serve as introductions to the outlook for reasonably foreseeable future development (RFD) in the GDBR and the greater Uinta Basin. The cumulative impact and RFD analysis is based upon the level of activities and actions identified in the Draft Vernal Resource Management Plan (RMP) and Draft EIS (BLM 2005). Of all activities considered, projected oil and gas activity would be the most significant expected in the Vernal Field Office area. Other significant activities would be livestock grazing, vegetative management through prescribed burning, and recreational projects. The Cumulative Impact Analysis Area (CIAA) for most resources is the Vernal Resource Area. The CIAA essentially includes identified actions in Uintah County and the neighboring Duchesne County to the west. For some resources, the CIAA is much larger. For example, the air quality modeling domain extends throughout northeast Utah into north central Colorado.

5.2 CUMULATIVE ACTIVITIES AND IMPACTS

5.2.1 History Leading to Present Situation of Oil and Gas Development

Oil and gas exploration and development within the Uinta Basin was initiated in the late 1920s. The first well to discover gas, the Continental Oil #1, was located within the Chapita Wells Unit and was drilled and completed in 1952. Reserves from this historical natural gas well were depleted within a few months. The Continental Oil #2 well, also located within the Chapita Wells Unit was completed in 1955 and was a productive natural gas well for several decades. Since these initial discoveries, about 15 gas fields have been discovered in the Greater Natural Buttes Gas field.

In the earlier years of Uinta Basin oil and gas development, the market for oil and gas fluctuated, was seasonal, and poorly priced because of the lack of a strong market. Tax incentives for “tight sands” gas development led to a spurt of drilling in the 1990s.

Pipeline Infrastructure

Historical pipeline and ROW development within the Uinta Basin was commensurate with the fluctuating market and oil and gas development. The first pipeline to take gas from the Uinta Basin was built by Northwest Pipeline in 1956. This 26-inch diameter pipeline ran from the San Juan Basin in New Mexico, through the Uinta Basin, to the Pacific Northwest. Two additional major pipelines were built in the 1960s; the Questar Mountain Fuel and Sinclair Oil Mesa pipelines. The Questar (Mountain Fuel) pipeline was constructed in order to take gas from the basin to the Wasatch front area in Salt Lake City. The Sinclair Oil (Mesa) pipeline was constructed in order to take gas from the basin to the Pacific Northwest.

By the 1980s, ROWs within the basin consisted of several hundred miles and continued to increase with increased oil and gas development. ROWs were, and continue to be, used for a variety of purposes, including oil and gas pipelines, communication lines, power lines, water pipelines, railroads, and roads.

In 1984, the two major north-south ROW corridors within the basin included the Seep Ridge Road in the central portion of the Uinta Basin and the Mapco pipeline route near the Utah-Colorado border, both of which served oil and gas pipelines. The State Highway 45 Vernal to Bonanza road running north-south shared a corridor with a water pipeline. In 1991, Colorado Interstate Gas built a 20-inch diameter pipeline to take gas from the basin to south-central Wyoming and then move gas east.

The Deseret-Western Railway is an electrical loop-to-loop railroad line that is actively used to ship coal 35 miles from the Deserado Coal Mine near Rangely, Colorado, to the Bonanza Power Plant near Bonanza, Utah, in the Uinta Basin. Although a 135-mile railroad line linking Vernal, Utah, to Rifle, Colorado, through Rangely was proposed in 2000, public opposition and lack of funding to complete feasibility studies have delayed the project indefinitely.

Designated corridors are currently BLM's preferred locations for placement of two or more linear ROWs that are similar, compatible, or identical. A major oil pipeline traverses east-west through the Uinta Basin. Major gas transmission lines travel north-south through the eastern part of Uintah County, and then east-west through the southern parts of Uinta and Duchesne counties (Chidsey 2003).

Most of the ROWs granted since 1984 have been for oil and gas gathering systems or roads, most of which were outside of designated corridors. Applications are currently being made by producing companies to construct and operate natural gas gathering systems particularly in the less-developed Uintah and Ouray Reservation. Gathering lines continue to be installed on the surface while larger pipeline (10+ inches) are buried. Existing utility windows, ROW concentration areas, and communication sites are the preferred locations for future ROW grants.

Additional natural gas transportation capacity is being planned to accommodate increasing production in the Uinta Basin. A 128-mile, 20 or 24-inch pipeline is planned to provide a direct link from the Basin to trading points in the Rocky Mountain region and give customers across the country additional access to Uinta Basin gas supplies. The new pipeline will add capacity of between 250,000 to 350,000 mmcfd (RigZone 2005).

ROWs are also being considered for projects other than the transportation of hydrocarbons. Additional early and late season irrigation water in addition to municipal and industrial water is needed to support moderately steady population growth in the Basin. A pipeline to transport water from lakes in the Uinta Mountains to locations in the Uinta Basin for municipal and agricultural use is currently being evaluated (CUWCD 2003).

<u>Road Infrastructure</u>

The major east-west corridor through the Uinta Basin was and continues to be U.S. Highway 40/191. The major north-south corridors continue to include Utah State 88 (south from U.S. 40 through Ouray), Utah State 45 (southeast from Vernal to Red Wash and Bonanza), and County Road 262 (north-south from U.S. 40 to Utah 45). Unpaved, gravel and natural material roads provide access to most of BLM-managed lands. Some historically unimproved roads have been recently surfaced to accommodate increased travel volumes by oil and gas personnel and equipment.

Compressors

Over the past several decades, installation of compressors throughout the oil and gas development areas in the Uinta Basin has increased to meet the demand of transporting the additional gas resulting from increased drilling. Emissions from compressors were not considered as significant pollutants in the early 1980s, when the primary pollutant of concern was particulates generated by the use of unimproved roads. Ambient air concentrations of criteria pollutants were, and remain today, within NAAQS standards. Currently, the main sources of emissions in the Basin consist of oil and gas production facilities, compression stations, the Deseret Power Plant, and mining sites.

Summary of Present Oil and Gas Infrastructure

At present, approximately 2,800 oil and gas wells are active within the Vernal Resource Area. Over the span of oil and gas development in the Vernal Resource Area, approximately 19,783 acres and 1,724 miles have been disturbed. Existing sources of oil and gas related surface disturbance include: approximately 33 compressor sites (approximately 2 acres of surface disturbance per site), existing pipelines such as gathering/injection lines (approximately 0.47 acres disturbed per well); transportation lines (approximately 0.15 miles disturbed per well, with 0.79 acre of surface disturbance per well); and approximately 73 miles of power lines (0.25 acres of surface disturbed per mile).

5.2.2 History Leading to Present Situation of other Public Land Activities

Along with oil and gas development, the basin has a rich history of other public land uses, all of which have contributed to the present situation within the GDBR and greater Uinta Basin. Some of the more significant historical activities in the basin and their present situations are discussed in the following sections.

Livestock Grazing

Twenty years ago, the BLM managed grazing lands according to common resource characteristics. By the mid-1990s, the BLM evaluated allotments according to seral stages. In order to manage grazing lands as integrated parts of an ecosystem, the BLM in Utah developed Standards for Rangeland Health and Guidelines for Grazing Management (1997), which described desired conditions of rangeland in consideration of watershed management.

Livestock grazing remains a permitted use of public lands. Although some minor changes may be expected over the next few years, it is reasonable to expect that livestock grazing will continue. Grazing allotments are currently evaluated as to desired conditions and whether their resource conditions should be maintained, improved, or placed in custodial management. The Vernal Field Office (VFO) currently administers grazing on 153 allotments. Of these, five grazing allotments (Dry Creek, Hoy Flat, Offield Mountain, South Pot Creek, and Wild Mountain–Colorado) are located entirely outside the VFO boundary and two allotments (Max Canyon and Blind Canyon) are located entirely on private land inholdings within the VFO boundary. The 143 allotments within the VFO boundary designated for livestock grazing encompass approximately 2,216,764 acres (1,670,877 acres of BLM land; 545,887 acres of private, state, and tribal lands).

Within the grazing allotments managed by the Vernal Field Office, 146,220 animal unit months (AUMs) are allocated for livestock, but active permitted use for the 146 allotments is currently 137,897 AUMs.

However, the demand for forage resources by livestock (the total average actual use) for the past 10 years was only 78,500 AUMs. Suspended use for the 160 allotments is currently 26,364 AUMs.

Weed Management

Noxious and undesirable weeds have become recently been recognized as threats to native vegetation in many areas of the Uinta Basin. Collaborative weed management agencies have been formed during the last 20 years to pool resources for weed control and public education. These agencies include the National Park Service (NPS), BLM, U.S. Forest Service (USFS), UDWR, the Ute Indian Tribe, and SITLA. Weed infestation in the Uinta Basin has been exacerbated by increasing human activities such as OHV use, construction resulting in soil disturbance, and wildlife and domestic livestock grazing activities.

Fire Management and Prescribed Burning

From 1973 to 1984, an average of 7.6 wildfires occurred annually in the basin, burning an average of 137.4 acres each year. Prescribed burning was limited to sagebrush canyon bottoms to increase access and forage for deer and elk during summer months. Fire suppression was limited by a lack of funds. Since that time, fire management policy on BLM-administered lands has evolved and included the development of a State-wide Fire Management Plan, which included fire prevention, preparedness, suppression, and use as well as subsequent restoration and rehabilitation. The plan is currently implemented on an interagency basis. More than 1,000,000 acres have been identified in the Uinta Basin as currently needing fire treatments to reduce fuel loads (including some oil and gas fields and popular hunting and fishing areas) and increase forage for livestock and wildlife.

Prescribed burning continues to be BLM’s primary method of vegetative treatment in the Vernal Resource Area. This treatment method results from BLM’s acknowledgement of, and directives to use, fire as an integral tool to maintain and/or improve native rangelands. To meet management objectives, current BLM projects prescribed fires on 155,425 acres per decade, or an average of 15,542 acres per year. Target vegetation communities include pinyon-juniper, oak, aspen, and conifer. Although fire initially destroys plant material, the vegetation eventually recovers and returns to a more native plant community except where invasive annuals such as cheatgrass have invaded.

Recreation

BLM-managed lands in the Uinta Basin have provided opportunities for dispersed recreation over the last 20 years. Dispersed recreation opportunities have historically consisted primarily of hunting, ORV use, sight-seeing, fishing, and river floating. Musket Shot Springs and PR Spring contained limited developed facilities on BLM lands. Other recreation areas in the Uinta Basin include Steinaker Red Fleet Reservoir, Dinosaur National Monument, and the Ashley National Forest. Recreational use of lands in the basin has been rising in popularity with users originating from throughout the intermountain west. Dispersed activities remain similar to those in the past. Casual use of the White and Green Rivers has been increasing recently. Tourism in the Uinta Basin in general has been increasing.

Current recreation proposals potentially affecting cumulative impacts in the Vernal RMP area include proposed designations of Backcountry Byways and Special Recreation Management Areas (SRMAs), trail and cabin development, and mitigation of noise and light. These designations and developments would have beneficial impacts on recreation and would also affect the management of other resources in the CIAA.

Socioeconomics

During the latter decades of the 20th century, minerals development has replaced agriculture as the basin's most important private industry. As energy-related development grew and traditional farming and ranching lost its importance, the standard of living increased. Availability of housing, capacity of schools, and availability of medical care have been driven by cycles in the petroleum industry activity. As the national demand for energy grew, counties in the Basin have grown in population and economic vitality. As the oil and gas and public land industries grew, retail trade, private services and government services also grew.

5.2.3 Current Situation

The Energy Crisis

The U.S. currently faces an energy challenge. As recently as April 5, 2005, Federal Reserve Chairman Alan Greenspan commented extensively on this challenge. He stated, "Markets for oil and natural gas have been subject to a degree of strain over the past year not experienced for a generation. Increased demand and lagging additions to productive capacity have combined to absorb a significant amount of the slack in energy markets that was essential in containing energy prices between 1985 and 2000 (Greenspan 2005a)."

Despite diminishing available supplies and rising costs, the U.S. currently consumes over seven billion barrels of oil a year. U.S. crude oil production, which declined following the oil price declines in 1986, leveled off in the mid-1990s, and began falling again following the sharp decline in oil prices of late 1990s. During 2003, the U.S. produced around 7.8 million barrels per day (bbl/d) of oil, of which 5.7 million bbl/d was crude oil, and the rest natural gas liquids and other liquids. U.S. total oil production in 2003 declined sharply (around 2.8 million bbl/d, or 26%) from the 10.6 million bbl/d averaged in 1985. U.S. crude production, which averaged 5.4 million bbl/d during the first ten months of 2004, is now at 50-year lows (EIA, 2005).

From 1990 through 2003, natural gas consumption in the U.S. increased by about 15 percent. In 2002, the U.S. used about 22.8 Tcf of natural gas, making it one of the worldwide leaders in natural gas consumption. Factors determining the short-term demand for natural gas include weather, fuel switching, and the national economy. Factors determining more recent shortfalls in available energy supplies include but are not limited to loss of production due to Hurricane Katrina, increased transport of Rocky Mountain-produced oil and gas to eastern states, and rising import costs. For example, since 1978, the largest oil disruption occurred at the time of the 1978-1979 Iranian revolution, followed by the Gulf War in 1991, and the Iran-Iraq War in 1981. Hurricane Katrina shut down oil and gas production from the Outer Continental Shelf in the Gulf of Mexico, the source for 25 percent of U.S. crude oil production. Several oil refineries that provide a significant share of the nation's refined petroleum products were still shut down as recently as September 2005 along the Gulf Coast in Louisiana and Mississippi (IEA 2005). In addition to these factors, the following five observed gas industry features and trends support the argument that there exists a serious and persistent gas supply and demand crisis (Bamberger et. al. 2005):

- Prevailing future prices and forward price curves of natural gas;
- Gas demand growth expectations;
- The near exhaustion of storage inventories over past winter seasons;
- Rapid deliverability decline rates from recently drilled gas wells; and

- The inability to muster a timely industry response for faster natural gas production.

Today, hydrocarbon extraction is increasingly influenced by worldwide energy prices. The immediate demand for and solutions for adequate supply of crude oil and natural gas is uncertain. However, home to vast reserves of traditional fossil fuels, the Rocky Mountain region, including the Uinta Basin, is emerging as a strategic place in the evolving national energy picture. Forecasts by the USGS predict that known reserves from the region could keep the U.S. at current levels of demand, supplied with natural gas for eight years.

Global Response to the Energy Crisis

Individually and collectively, nations have responded to energy supply disruption by increasing the available market supply of oil and gas. The International Energy Agency (IEA), an intergovernmental body committed to advancing the security of energy supply, has led efforts to formulate international agreements defining contingency plans that provide for the immediate availability of reserved hydrocarbons. During periods when global oil markets were tight and affected by low inventories and high uncertainty, reserved hydrocarbons were released from stockpiles. Crude oil and products were made available in response to supply disruptions caused by Hurricane Katrina. IEA response preparations include the reinforcement of the efforts of oil-producing countries by committing to increased indigenous production (IEA 2005). Increasing indigenous production within the U.S., including production in the Uinta Basin, is a direct response to shortfalls in the national supply.

Nationally, government directives were issued to address procedural mechanisms that facilitate the exploration and production of hydrocarbons within the U.S. The National Energy Policy Development (NEPD) Group recommended in 2001 that the President issue an Executive Order to direct all federal agencies to include in any regulatory action that could significantly and adversely affect energy supplies, distribution, or use, a detailed statement on: (1) the energy impact of the proposed action, (2) any adverse energy effects that cannot be avoided should the proposal be implemented, and (3) alternatives to the proposed action. The NEPD Group also recommended that the President direct the executive agencies to work closely with Congress to implement the legislative components of a national energy policy.

The Bush administration on August 7, 2003, announced new policies to streamline the oil and natural gas permitting process on federal lands overseen by the BLM. The BLM was instructed not to unduly restrict access to oil and natural gas on federal lands. The new policies explicitly directed the BLM to act most expeditiously on permit applications where unnecessary delays could result in the suspension or abandonment of a proposed energy recovery project. The Bush administration singled out seven geographic areas as a primary focus for the new instructions, one of which was the Uinta Basin. The mean estimate for energy reserves in all seven focus areas is 5.5 billion barrels of oil and 184 trillion cubic feet of natural gas. The natural gas reserves represent more than 800 percent of the nation’s annual natural gas consumption (White House, 2001).

The Energy Policy Act of 2005 is a statute which was passed by the U.S. Congress on July 29, 2005 and signed into law on August 8, 2005. The Act is intended to combat growing energy problems. The President’s National Energy Policy outlined a number of recommendations to diversify and increase energy supplies, encourage conservation, and ensure environmentally responsible production and distribution of energy. As a result, the BLM developed a plan containing 54 tasks designed to implement the President’s directives. The Director of the BLM sent out the new guidance September 30, 2005. In 2004, the BLM approved 6,052 drilling permits from about 7,000 applications submitted, a 60 percent jump in new permits over those issued in 2003. This year, BLM expects it will approve 7,000 of the 8,000 new applications (NewsMax 2005).

BLM and Industry's Response to the Energy Crisis

Shortfalls in the oil and gas industry are found in the production and infrastructure of supply of oil and natural gas, principally with lack of excess oil refining capacity. However, given existing and expected demand for oil and natural gas into the future, extensive investment is needed in oil and natural gas exploration, technology, and production, and transportation, as well as in refining capabilities.

The major challenge facing the oil and natural gas industry is to ensure that existing and newly discovered resources can be produced in an economically and environmentally sound manner to meet increasing demand and offset the field decline. To increase oil and gas supply (both reserves and resources) to meet the future demand, the industry has and will continue measures that include the following:

- Expand exploration activities, at greater depths on land and in deeper water at sea, and at more substantial distances from consuming markets;
- Maintain vigorous programs in research and development;
- Develop new and better technologies for exploration and production;
- Improve recovery in existing fields;
- Improve existing environmental safeguards and develop new environmental protection techniques to allow for access to environmentally sensitive areas, such as Alaska, off-shore California and Florida, and in other parts of the world;
- Reduce public and governmental fears about environmental impacts to allow for greater access to potential exploration targets;
- Lower costs and increase operational efficiency;
- Work out reasonable tax and fiscal regimes that recognize the capital intensity, cost structure, long pre-production time periods and risks associated with the industry; and,
- Work for political stability in key energy-producing regions such as in Russia and the Middle East.

With higher prices now prevailing, secondary and tertiary recovery techniques are anticipated to boost future production rates and ultimate recovery from known gas fields. Higher gas price expectations have prioritized many marginal high risk/high reward projects as exploration and production companies review and pursue their prospect inventories. Favorable economics have allowed and encouraged Uinta Basin operators to utilize technologies to maximize production and drill to deeper natural gas targets that may previously have been unfeasible. Structural controls are a major factor in exploration of the deep over-pressured plays in the Uinta Basin. The best practices for current recovery often include waterflood, CO_2 injection, and horizontal drilling. Recent successes of new technology in the Uinta Basin have included gas production from the deep Triassic Wingate and the Jurassic Entrata formations (DOE 2005).

Proven reserves for Utah are relatively high, at 283 million barrels. Utah oil fields have produced a total of 1.2 billion barrels of oil. However, the 13.7 million barrels of oil production in 2002 was the lowest level in over 40 years and continued the steady decline that began in the mid-1980s. In 2003, 138 Bcf of natural gas were produced on public lands in Utah, providing enough energy to heat more than 1.6 million homes, twice as many homes as there are in Utah. Four million barrels of oil were also produced on Utah public lands in 2003, enough to produce 79.6 million gallons of gasoline and 38 million gallons of diesel/heating fuel as well as other products.

The Role of the Uinta Basin in the Current Energy Crisis

The Uinta Basin is a significant source of natural gas and oil, and it is currently one of the most active oil and gas producing areas in the onshore U.S.

In September 2004, the Utah BLM's quarterly oil and gas lease sale broke the record of most acreage, revenues, and bidders for any lease sale. The focus of the bidding seemed to be both on known producing areas in the Uinta Basin and in frontier areas in the central portion of the state. In the case of the Uinta Basin, past exploration has been in shallow areas up to 8,000 feet. Companies are just now beginning to tap the huge gas reserves that are 10,000-20,000 feet deep due to new technology and economics (BLM 2004b).

Oil and gas development is at an all-time high in the basin, with more rigs operating, and more applications for permit to drill (APDs) being processed than ever before. For example, over half (i.e., 8,737 wells) of the total oil and gas wells drilled in Utah between 1911 and November of 2000 were drilled within the Uinta Basin. APDs and ROWs processed by the BLM VFO have illustrated a significant upward trend, estimated to be approximately 15 percent annually. At this time, more than 5,800 wells (including the wells proposed by this action) associated with 11 different projects are being proposed for drilling in the Uinta Basin by various oil and gas operators (BLM 2005). These 11 projects, summarized in Table 5-1 below, are being evaluated under the authority of NEPA prior to approval of project-specific APDs. The BIA was contacted concerning future development of the Noval Oil Shale Reserve #2. The BIA had no definite plans for development at this time.

Because horizontal and vertical hydrocarbon occurrence in the Uinta Basin is well understood, exploration and development within the Uinta Basin allows for lower risk projects than exploration in other unproven areas. Three fields in this Uinta Basin (i.e., Altamont, Bluebell and Cedar Rim) have produced about 31 percent of Utah's oil. Wells in the Altamont-Bluebell Field, which historically has produced over 350 million barrels of oil equivalent, are currently being recompleted in additional zones in the Green River Formation to further increase daily production potential. Due to the over-pressured, fractured nature of the reservoir in the field, as well as the large vertical extent of potential pay zones, many of the wells have formation damage resulting from past high drilling mud weights and cementing operations. These conditions have left many zones unable to produce to their potential. However, a variety of conventional and innovative proprietary techniques are expected to reduce the effects of formation damage and increase oil and gas recovery.

Table 5.1. Existing and Ongoing Oil and Gas Field Development Projects in the CIAA

Project	Lead Agency	Date of Decision Record / ROD or Anticipated Completion Date	Number of Approved / Proposed Well Pads*
Existing Oil and Gas Field Development NEPA Documents			
EA (No. 3) of Oil and Gas Development in the Duchesne River Area	BLM	Jan-82	41
Antelope Creek Oil and Gas and Secondary Recovery Applications from Water Flooding EA	BIA	Jan-95	193
Monument Butte / Myton Bench EA (EA No. UT-080-1994-77)	BLM	Jun-95	296
Brundage Canyon Oil and Gas Field Development	BLM/BIA	Jan-97	120
Chapita Wells EA	BLM	Jan-98	99
Wexpro Company EA Island Unit (EA No. UT-	BLM	Apr-99	97

Project	Lead Agency	Date of Decision Record / ROD or Anticipated Completion Date	Number of Approved / Proposed Well Pads*
080-1997-51)			
Final EA of Coastal's Proposed Development of the Ouray Field	BIA	Jan-00	232
Chapita Wells Unit Infill Development EA (EA No. UT-080-1999-32)	BLM	Apr-00	161
North Hill Creek Field Development EA	BIA	Nov-02	150
Antelope Creek Field Expansion EA	BIA	Jan-03	478
EA for the Antelope Creek Field Expansion	BIA	Jan-03	288
Supplemental EA for Modifications to the Antelope Creek Oil and Gas Field Expansion / Infill and Thermal Recovery Projects	BIA	Mar-04	445
Tabby Canyon Oil and Gas Field Development EA	BIA	Sep-04	24
Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS	BLM	Aug-05	776
Castle Peak and 8-Mile Flat EIS	BLM	Aug-05	920
West Brundage Canyon Oil and Gas Field Development EA	BIA	Sep-05	72
	Total Approved Wells		**4,392**
Ongoing Oil and Gas Field Development NEPA Documents			
North Chapita Natural Gas Field Development EA	BLM	Jan-06	264
West Bonanza EA	BLM	Jul-06	133
Bonanza Area EA	BLM	Oct-06	94
Chapita Wells-Stagecoach Area EIS	BLM	Oct-06	627
Greater Deadman Bench EIS	BLM	Oct-06	1,239
Resource Development Group EIS	BLM	Aug-06	420
Sowers Canyon Oil and Natural Gas EA	USFS	Aug-06	14
Love Unit EA	BLM	Oct-06	130
Riverbend Natural Gas Drilling Project EA	BLM	Sep-06	49
LCU/HCU/BPU EA	BLM	Sep-06	513
Gasco Development EIS	BLM	Oct-07	1,500
	Total Proposed Wells		**4,983**

* Number of proposed wells includes best estimate at the time of publication of this EIS.

Many of the wells in the Uinta Basin are drilled in and around producing gas fields with an established midstream infrastructure. These types of prospects were first brought on-stream as a result of a multi-month price spike, such as the 2000-2001 gas price excursion during the California power crisis. These gas wells are predominantly field extensions or infills and are low-risk targets designed to capture a short-term opportunity. Increased demand, however, has highlighted constraints in the existing gas transmission infrastructure of the Uinta Basin, attracting capital to capture the large price differentials that develop when gas volumes are too high for available pipeline capacity, such as in the Rocky Mountain states (Linden 2003). Areas of infill drilling in the Uinta Basin are located primarily in its eastern portion.

Exploratory drilling is currently proposed in the western and southwestern portions of the Uinta Basin, including BLM, Tribal and National Forest lands. Exploration projects consist of larger and more expensive prospects. Production of exploratory wells typically lags discovery by many years. These exploratory wells are typically characterized by larger, deeper, more remote locations requiring greater per-well expenditures, potential delays in infrastructure access and, therefore, greater financial risk (Linden 2003).

5.2.4 Future Situation / Reasonably Foreseeable Development

The immediate demand for and solutions for adequate supply of crude oil and natural gas is uncertain. The longer-term outlook for oil and gas is even more conjectural and will largely depend on the response of demand to price. The resolution of current major geopolitical uncertainties will materially affect oil prices in the years ahead and will significantly influence the levels of investments over the next decade in raising crude oil productive capacity and investment in refining facilities (Greenspan 2005b). In the future, domestic supplies of oil and gas are expected to remain inadequate to meet national demand. Over the past few years, notwithstanding markedly higher drilling activity, the U.S. natural gas industry has been unable to noticeably expand production. The reality is that our domestic production is declining. “We now produce nearly 40 percent less oil than we did in 1970. The projection is just over five million barrels per day by 2020, down from a high of 9.4 million barrels per day 30 years ago. Failure to meet this challenge may harm our prosperity, damage our national security, and may affect the way we live our daily lives (Norton, 2001)." North America, however, still has numerous unexploited sources of gas production. The North American resource base, variously estimated at 1,500 to 2,000 Tcf, indicates a domestic industry entering the decline mode some 20-30 years in the future. Incremental, market-based capital investment accelerating exploration and development of available North American gas resources would help to alleviate future shortfalls (Linden 2003).

Future oil and gas production estimates fall into three categories: proven reserves, inferred reserves, and undiscovered resources. Utah's inferred or grown reserves are not publicly available since these data are proprietary. However, using publicly available production records, field age records, and proven reserve estimates, an estimate for inferred oil and gas projects that an additional 641 MMBO and 6.08 TCF of gas will be extracted from within or immediately adjacent to existing fields in addition to the proven reserves. Thus, the total amount of oil and gas in or near the existing areas of large-scale production is estimated at 912 MMBO and 10.68 TCF respectively. Undiscovered resources reflect estimates of oil and gas in areas distinct from existing oil and gas fields. The estimated amount of technically recoverable undiscovered resources in the entire state of Utah is 436 MMBO and 15,668 BCF of natural gas. These estimates represent technically recoverable resources, i.e. resources producible using existing technology without regard to the economic viability of recovering the resource (Lemkin, N.D.).

Factors determining the long-term demand for natural gas include residential and commercial demand, industrial demand, electric generation demand, and transportation sector demand. U.S. natural gas consumption and imports are expected to expand substantially in coming decades, with the fastest volumetric growth resulting from additional natural gas-fired electric power plants. Increased U.S. natural gas consumption will require significant investments in new pipelines and other natural gas infrastructure. The Energy Information Administration (EIA), in its Annual Energy Outlook 2004, estimates that natural gas demand in the U.S. could be 31.41 Tcf by the year 2025. That is an increase of 38 percent over 2002 demand levels of 22.8 Tcf. That is compared to an expected total energy consumption increase (from all sources) of 40 percent (from 97.7 quadrillion British thermal units to 136.5 by 2020). The EIA predicts a 1.4 percent annual increase in demand over the next 21 years. While forecasts made by different Federal agencies may differ in their exact expectations for the increased demand for natural gas, one thing is common across studies: demand for natural gas will continue to increase steadily for the foreseeable future (Natural Gas Supply Administration, 2004).

Future oil and gas development in the Uinta Basin will depend upon the feasibility of exploration as determined by the underlying geology and further infill development projects within the Basin. Future development will be dependent upon the geologic feasibility each prospect, the cost to develop the resources, and engineering technological advancements. Development of Tribal lands will continue and perhaps increase as exploratory wells are drilled in the Hill Creek Extension. Drilling in the Ashley National Forest will likely increase with new leasing and management strategies.

RFD on Tribal and USFS-Administered Lands

The Uinta Basin includes the Uintah and Ouray Indian Reservation, which has been drilled for hydrocarbons from the 1940s to the present. However, little oil and gas development occurred after the 1970s, and large areas of the 1.2 million-acre Indian reservation remain unexplored. Even after a large natural gas pipeline was constructed nearby, oil and gas development was slow until recently because of weak gas markets. Today, there are several ongoing or recently approved oil and gas exploration and development projects on Tribal lands, including the Brundage Canyon, West Brundage Canyon, Tabby Canyon, and Antelope Creek projects (BIA 2005). Oil and gas development on Tribal lands is expected to grow over the next several years. Three-dimensional (3D) seismic surveying techniques are now being used extensively on the Uintah and Ouray Indian Reservation to identify future drilling targets (NETL 2004), the results of which are expected to increase development in such areas as the Tumbleweed Field and the former Naval Oil Shale Reserve #2. However, no firm plans are in place for NOSR #2.

The Uinta Basin also includes public lands managed by the USFS, where oil and gas leasing, seismic exploration, exploratory drilling, and gas field development are also expected to increase over the next several years. For example, on the USFS' Schedule of Proposed Actions (SOPA) for the Ashley National Forest, two exploratory gas well projects and one 2-D seismic exploration project were proposed between April 2005 and November 2005. In the Uinta National Forest, one exploratory gas well and one leasing proposal were listed on the SOPA between April 2005 and November 2005 (http://www.fs.fed.us/sopa.shtml).

RFD on BLM-Administered Lands

As part of the ongoing Vernal RMP Revision, the Vernal BLM Geologic and Engineering Team developed a RFD scenario for oil and gas development. The RFD projects that 6,530 oil and gas wells (2,055 oil wells, 4,345 gas wells, and 130 CBM wells) will likely be drilled applying the management directives under the Preferred Alternative. The majority (4,800 wells) of the oil and gas development activity is expected to occur in the Monument Butte-Red Wash exploration and development area, which contains the GDBR project in the eastern part of this region. Thus, the GDBR would constitute 25.8 percent of the level of RFD expected in the Monument Butte-Red Wash exploration area, and 18.9 percent of overall development in the Vernal Resource Area. Some of the currently proposed projects comprising this reasonably foreseeable disturbance are included in the list of NEPA projects outlined in Table 5-1.

Recent BLM monitoring has documented that interim reclamation efforts in oil and gas development areas have largely been unsuccessful at reestablishing soil stability and vegetation. Accordingly, BLM field inspections are indicating that initial disturbance should be more accurately portrayed as long-term impacts for the life of the project. Therefore, the acreage initially disturbed for construction, drilling, and completion would potentially remain void of desired vegetation for the long-term length of oil and gas development in the Vernal Resource Area. Thus, from past activities, the following surface disturbance assumptions have been applied regarding future construction associated with oil and gas development:

- Surface disturbance for a well pad: 2.0 acres;
- Surface disturbance for an access road: 1.5 acres/well;
- Surface disturbance for pipelines and flowlines: 0.47 acres/well;

- Surface for compressor stations: 2 acres;
- Surface disturbance for water pipelines: equals disturbance for oil well roads; and
- Surface disturbance for new sales pipelines: 0.47 acres for every new well.

Based on these assumptions, the cumulative surface disturbance of reasonably foreseeable oil and gas development would be approximately 31,175 acres. Disturbance associated with the GDBR project is estimated to be 1,736 acres (5.6 percent of the cumulative total). The individual components of reasonably foreseeable surface disturbance are shown in Table 5.2.

Table 5.2. RFD Surface Disturbance

Type of Well	# Wells	Well Pads (acres)	Access Roads (acres)	Surface Pipelines (acres)	Compressor Stations (acres)	Water Pipelines (acres)	Sales Pipelines (acres)
Oil	2,055	4,100	3,082	966		3,082	
Gas	4,345	8,690	6,517	2,042	138		2,042
CBM	130	260	195	61			
Total Disturbance (Acres)		13,050	9,794	3,069	138	3,082	2,042
Total RF Surface Disturbance (acres)			**31,175**				

5.3 CUMULATIVE IMPACTS ASSOCIATED WITH THE PROPOSED ACTION

5.3.1 Geology and Minerals

Cumulative impacts on geology and mineral resources in the CIAA would primarily occur as a result of oil and gas development, which would deplete recoverable oil and gas from the formations underlying the CIAA and alter local topography due to surface disturbance. Extraction of mineral resources from formations underlying the CIAA would be irreversible and would cumulatively add to depletions of oil and natural gas resources across the CIAA. Cumulative impacts to surficial geology would result from the approximately 50,310 acres of past, present and reasonably foreseeable surface disturbance in the CIAA associated with oil and gas development, its associated road development, and other mining and industrial activities (including for example, potential gilsonite leasing of up to 520 acres). Many of the NEPA projects listed in **Table 5-1** discuss direct, indirect, and cumulative impacts to geology and minerals in qualitative terms, and the reader is referred to those individual documents for project-specific discussions on these resources.

Minerals development in the CIAA has been extensive and is expected to continue at this level. Exploration for oil and gas reserves has diminished as infill projects are developed in known fields. Infill drilling continues to be proposed on decreased spacing, resulting in increasingly greater density of surface disturbance and installation of facilities.

No geologic hazards were identified in the CIAA by the Mineral Potential Report for the Vernal Planning Area (BLM 2004e) that would be exacerbated by oil and gas development.

5.3.2 Water Resources

Cumulative impacts to water resources in the CIAA would result from agriculture, livestock grazing, vehicular traffic, oil and gas development, and other mining and industrial activities. Surface disturbance resulting in effects to water resources in the CWSA would contribute incrementally to those cumulative impacts analyzed for the CIAA by increasing erosion into the White River and its tributaries, increasing potential for water quality degradation, and contributing to depletions of the Upper Colorado River Basin.

Many of the more recent NEPA documents outlined in **Table 5-1** (i.e., Tabby Canyon Oil and Gas Field Development EA, Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS, West Brundage Canyon Oil and Gas Field Development EA, Chapita Wells/Stagecoach Area EIS, West Bonanza EA, Bonanza Area EA, Resource Development Group EIS, Sowers Canyon Oil and Natural Gas EA, Love Unit EA, Riverbend Natural Gas Drilling Project EA, LCU/HCU/BPU EA, and Gasco Development EIS) include project-specific discussions on soil loss, and sediment yield.

According to the Vernal RMP analysis, approximately 391,000 acres within the Vernal Resource Area would be susceptible to erosion. However, the location of individual facilities on these erodible soils is unknown. The soil erosion analysis, using the Revised Universal Soil Loss Equation, for GDBR indicated an average annual soil loss of 1,649 tons for 1,239 wells, or 1.331 tons/acre/year/well and associated access road. Soil loss resulting from oil and gas activities within the entire Vernal Resource Area can be estimated using the value calculated for GDBR. The RFD well projection is 6,218 wells and associated facilities. Therefore, the average annual increase in soil loss resulting from the reasonably foreseeable oil and gas activities would be 8,276 tons/year the GDBR would contribute 20% of the increase or 1,649 tons/year.

Over time, this sedimentation would be carried to the tributaries of the Green and White Rivers and eventually to the Green River. Sediment loading in the Green River at Jensen, Utah, 20 miles upstream from the GDBR, averages around 807,000 tons/month (ranging between 52,651 and 3,231,564 tons/month) or 9,684,000 tons/year (Lentsch, et al. 2000). If all of the sedimentation from RFD activities would eventually reach the Green River, sediment loading would increase by only 0.09 percent.

5.3.3 Air Quality

Sources within 50 kilometers of the GDBR were included in the near-field air quality cumulative analysis. These sources were identical to the ones being evaluated for the Vernal RMP. Two source groups were considered. The first group was sources that had had been identified or permitted but were not yet in operation during the year that the background data was determined. The second source consisted of compressor stations and dust-producing activities that would be operated as part of the oil and gas RFD. The total of these sources within 50 kilometers of GDBR would be 243 tons per year of NO_x, 785 tons per year PM_{10}, and 694 tons per year CO. These sources are described in the GDBR Air Quality Technical Report, Appendix 4.1.

The incremental cumulative effect of the other sources in addition to GDBR sources is very small. As shown in Table 5-3, increases would be small.

Table 5-3. GDBR Proposed Action vs. Cumulative Impact Comparison

Pollutant	Averaging Time	Project Maximum Predicted Impact (µg/m^3)	Project plus Cumulative Sources Maximum Predicted Impact (µg/m^3)	% of NAAQS	Incremental Increase of Cumulative Sources (µg/m^3)
NO_2	Annual	20.56	20.70	20.7%	0.14
CO	1-hour	984.7	985.1	2.5%	0.4
	8-hour	301.3	301.8	3.0%	0.5
PM_{10}	Annual	4.68	4.89	9.8%	0.21
	24-hour	15.77	22.17	44.3%	6.40

The Vernal RMP air quality analysis identified cumulative sources based on the RFD and new sources that were permitted to or had actually begun operations after 2001, the baseline year. Additionally, RFD sources were identified in the Glenwood Springs Resource Area as well as other cumulative sources in Colorado. The methods of the emissions inventories and the CALPUFF modeling methodologies are presented in the Vernal RMP Air Quality Technical Report. The results are shown to indicate the magnitude of impacts identified and the insignificant cumulative contribution of the proposed GDBR project. In most cases, the impacts from the GDBR project would be 2 to 3 orders of magnitude less than the cumulative effect.

Table 5-4. Comparison of Pollutant Concentrations at Class I/II Areas

Area	NO_2 Annual Average		PM_{10} Annual Average		PM_{10} 24-Hour Maximum	
	All (µg/m^3)	GDBR (µg/m^3)	All (µg/m^3)	GDBR (µg/m^3)	All (µg/m^3)	GDBR (µg/m^3)
Class I Areas						
Arches NP	0.0179	0.00028	0.0225	0.00102	0.2604	0.00304
Black Canyon of the Gunnison NP	0.0043	0.00002	0.0395	0.00046	0.9189	0.00272
Canyonlands NP	0.0210	0.00018	0.0189	0.00066	0.2892	0.00224
Capitol Reef NP	0.0005	0.00004	0.0036	0.00043	0.1470	0.00270
Eagle's Nest WA	0.0100	0.00002	0.0454	0.00005	0.4452	0.00053
Flat Tops WA	0.0181	0.00006	0.1029	0.00080	0.6003	0.00775
Maroon Bells-Snowmass WA	0.1887	0.00002	0.0562	0.00045	0.4717	0.00109
Mt Zirkel WA	0.0963	0.00013	0.0925	0.00058	0.7351	0.00152
Rawah WA	0.0020	0.00008	0.0033	0.00037	0.1072	0.00126
Class II Areas						
Brown Park NWR	0.0087	0.00393	0.0234	0.00627	0.2163	0.00918

Area	NO_2 Annual Average		PM_{10} Annual Average		PM_{10} 24-Hour Maximum	
	All (μg/m^3)	GDBR (μg/m^3)	All (μg/m^3)	GDBR (μg/m^3)	All (μg/m^3)	GDBR (μg/m^3)
Colorado NM	0.0403	0.00014	0.0661	0.00132	0.5945	0.02570
Dinosaur NM	0.0309	0.03772	0.0742	0.04420	0.8658	0.12900
Flaming Gorge NRA	0.0058	0.00289	0.0171	0.00452	0.1552	0.00806
High Uintas WA	0.0116	0.00054	0.0103	0.00132	0.2029	0.01180
Holy Cross WA	0.0085	0.00002	0.0471	0.00036	0.3946	0.00161
Hunter-Frying WA	0.0039	0.00001	0.0351	0.00033	0.3129	0.00075
La Guirta WA	0.0004	0.00001	0.0104	0.00023	0.1982	0.00057
Ouray NWR	0.0963	0.00011	0.0925	0.00071	0.7351	0.00268
Ragged WA	0.0044	0.21621	0.0388	0.94000	0.4032	0.12300
Weminuche WA	0.0005	0.00001	0.0082	0.00016	0.1690	0.00193
West Elk WA	0.0026	0.00002	0.0278	0.00020	0.5039	0.00065

NO_2 Class I increment = 2.5 μg/m^3
PM_{10} Annual Class I Increment = 4 μg/m^3
PM_{10} 24-Hour Class I increment = 8 μg/m^3

Table 5-5. Comparison of Nitrogen Deposition at Class I/II Areas

Class I/II Area	All Sources		GDBR	
	(kg/ha/yr)	Percent of Significance Threshold	(kg/ha/yr)	Percent of Significance Threshold
Class I Areas				
Arches	3.83E-03	0.128%	1.77E-04	0.006%
Black Canyon	3.34E-03	0.111%	1.39E-04	0.005%
Canyonlands	3.73E-03	0.124%	1.61E-04	0.005%
Capitol Reef	2.85E-04	0.010%	2.48E-05	0.001%
Eagle's Nest	7.90E-03	0.263%	1.35E-04	0.005%
Flat Tops	1.15E-02	0.383%	2.33E-04	0.008%
Maroon Bells-Snowmass	4.95E-03	0.165%	1.16E-04	0.004%
Mt Zirkel	6.00E-02	2.000%	2.98E-04	0.010%
Rawah	1.19E-02	0.397%	1.99E-04	0.007%
Class II Areas				
Brown Park NWR	5.68E-03	0.189%	2.13E-03	0.071%
Colorado NM	8.74E-03	0.291%	1.79E-04	0.006%
Dinosaur	1.30E-02	0.433%	9.05E-03	0.302%
Flaming Gorge NRA	7.90E-03	0.263%	1.38E-03	0.046%
High Uintas	4.34E-03	0.145%	2.61E-04	0.009%

Class I/II Area	All Sources (kg/ha/yr)	All Sources Percent of Significance Threshold	GDBR (kg/ha/yr)	GDBR Percent of Significance Threshold
Holy Cross	5.84E-03	0.195%	1.36E-04	0.005%
Hunter-Frying	4.53E-03	0.151%	1.28E-04	0.004%
La Guirta	2.21E-03	0.074%	1.28E-04	0.004%
Ouray NWR	1.70E-02	0.567%	2.65E-02	0.884%
Ragged	3.72E-03	0.124%	9.72E-05	0.003%
USFS Request	1.74E-03	0.058%	1.68E-03	0.056%
Weminuche	2.93E-03	0.098%	1.15E-04	0.004%
West Elk	5.68E-03	0.189%	2.13E-03	0.071%

Table 5-6. Comparison of Visibility Impairment

Class I/II Area	GDBR Highest Δdv	GDBR Number of Days with Δdv > 1.	All Sources Highest Δdv	All Sources Number of Days with Δdv > 1.0
Class I Areas				
Arches	.08	0	1.17	1
Black Canyon	.04	0	2.87	2
Canyonlands	.07	0	.75	0
Capitol Reef	.07	0	.25	0
Eagle's Nest	.03	0	.62	0
Flat Tops	.05	0	1.17	1
Maroon Bells-Snowmass	.03	0	.72	0
Mt Zirkel	.06	0	1.35	1
Rawah	.04	0	.33	0
Class II Areas				
Brown Park NWR	.17	0	.39	0
Colorado NM	.06	0	2.39	3
Dinosaur	.42	0	1.44	3
Flaming Gorge NRA	.10	0	.52	0
High Uintas	.44	0	.05	0
Holy Cross	.04	0	.05	0
Hunter-Frying	.03	0	.04	0
La Guirta	.02	0	.04	0
Ouray NWR	1.51	4	1.30	3
Ragged	.02	0	.05	0
USFS Request	.02	0	.03	0
Weminuche	.04	0	.05	0
West Elk	.04	0	1.39	1

5.3.4 Soils

Cumulative impacts to soils would result from surface disturbance associated with oil and gas development, road and other construction activities in and around CIAA communities, construction of recreation facilities in more rural areas, such as campgrounds and trails, off-road vehicle travel, and livestock grazing.

Many of the more recent NEPA documents outlined in Table 5-1 (i.e., Tabby Canyon Oil and Gas Field Development EA, Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS, West Brundage Canyon Oil and Gas Field Development EA, Chapita Wells/Stagecoach Area EIS, West Bonanza EA, Bonanza Area EA, Resource Development Group EIS, Sowers Canyon Oil and Natural Gas EA, Love Unit EA, Riverbend Natural Gas Drilling Project EA, LCU/HCU/BPU EA, and Gasco Development EIS) include project-specific and cumulative impacts discussions on soil loss, and sediment yield.

As discussed in Section 5.3.2, approximately 391,000 acres within the Vernal Resource Area would be susceptible to erosion. However, the location of individual facilities on these erodible soils is unknown. The soil erosion analysis, using the Revised Universal Soil Loss Equation, for GDBR indicated an average annual soil loss of 1,649 tons for 1,239 wells, or 1.331 tons/acre/year/well and associated access road. Soil loss resulting from oil and gas activities within the entire Vernal Resource Area can be estimated using the value calculated for the GDBR. The RFD well projection is 6,218 wells and associated facilities. Therefore, the average annual increase in soil loss resulting from the reasonably foreseeable oil and gas activities would be 8,276 tons/year the GDBR would contribute 20% of the increase or 1,649 tons/year.

Many of the Uinta Basin soils have limitations on rehabilitation after disturbance, which is one of the primary factors in evaluating the effects of resource management decisions on soil function. Soil function can be defined as its ability to:

- **Regulate water:** Soil helps control where rain, snowmelt, and irrigation water go. Water and dissolved solutes flow over the land or into and through the soil.
- **Sustain plant and animal life:** The diversity and productivity of living things depends on soil.
- **Filter potential pollutants:** The minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits.
- **Cycle nutrients:** Carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled through soil.
- **Support structures:** Buildings need stable soil for support, and archeological treasures associated with human habitation are protected in soils.

Much of the CIAA exhibits low to moderate slopes, minimizing the need for extensive cut-and-fill; however, changes in topography resulting from slope alteration from either oil and gas development activities or mining may exacerbate slope stability in areas of steep slopes and unstable soils.

Vegetation disturbance, erosion, and sediment yield within the CIAA are likely to increase due to surface disturbance associated with oil and gas activities, livestock grazing/management, recreational activities, and naturally occurring erosion that are reasonably certain to occur. Many of the soils in the CIAA are derived from shale formations and are, therefore, highly erodible. Erosion results in direct soil loss where it occurs.

Grazing and other agricultural activities would also contribute to the loss of vegetation that would consequently impair soil function through diminished ability to cycle nutrients and regulate water. Increased competition for available forage may result if allocated AUMs are not decreased according to loss of forage from increased construction activities. Consequent impacts to soils could consist of increased sediment yield and loss of productivity.

As the demand for recreational opportunities increases within the CIAA, facilities such as campgrounds or other recreational development may be constructed near the White or Green rivers to facilitate convenient fishing opportunities or support White or Green River floating trips. The use of existing and newly constructed roads would increase access throughout the CIAA, possibly providing new access opportunities for recreationists. Although road densities contribute to the magnitude of erosion, construction of all-weather roads would reduce sediment loss. Off-highway vehicle use may also contribute to erosion and sediment yield into drainages that feed into water bodies in the CIAA.

5.3.5 Vegetation

The Vernal RMP analysis indicates direct surface disturbance and removal of vegetation from cumulative activities would be 187,363 acres (30,938 acres from oil and gas and 156,425 acres per decade from prescribed burns) over the next decade. Oil and gas activities would account for 16.5 percent of the total vegetation impact, and the GDBR project would account for about 2.5 percent. The nature of widespread oil and gas development would fragment native vegetation communities and suitable plant habitats, which could affect seed dispersal and limit distribution of native plant species.

According to BLM data files of mapped horseshoe milkvetch habitat, the proposed Greater Deadman Bench project is the only field development project that overlaps horseshoe milkvetch habitat. However, there are 13 plugged and abandoned wells, four producing wells, two temporarily abandoned wells, and two plugged wells within milkvetch habitat. Potential cumulative impacts to horseshoe milkvetch include loss or modification of potential habitat, habitat fragmentation caused by increased road and well pad development, the potential for the introduction and spread of invasive weed species, and sedimentation.

Prescribed burns are designed to be low-intensity burns to clear understory and weedy species in order to enhance or maintain rangeland conditions. Fire would initially destroy plants and would result in an adverse, short-term effect immediately following treatment. An increased risk of weed infestations would also occur. However, as the vegetation would recover and plant communities would return to a natural fire regime, long-term beneficial effects on the vegetation could occur except where invasive annuals such as cheatgrass would invade. Conversely, the loss of vegetation from oil and gas activities would be long-term, perhaps 30 years for the average life of a well. After reclamation, the recovery of vegetation would be on the order of years to decades.

Before any oil and gas development on federal lands, surveys would be required to determine the presence of federally-listed or sensitive plant species. These practices are generally effective in minimizing the potential effects to sensitive plant species because locations of pads and roads can be moved a maximum of 200 meters within a lease. Therefore, direct impacts to sensitive plant species should be minimal.

5.3.6 Wildlife

Direct cumulative impacts would primarily include loss of wildlife habitats through surface disturbing activities. As discussed in Section 5.3.3, direct surface disturbance and removal of vegetation from cumulative activities in the Vernal RMP area would occur on 187,363 acres over the next ten years. Oil and gas activities would account for 16.5 percent of the total vegetation impact, and the GDBR project would specifically account for about 2.5 percent. While vegetation disturbance does somewhat correspond to associated wildlife habitat loss, accurate calculations of cumulative habitat loss are not determinable because the direct impacts of habitat disturbance are species-specific and dependent upon (1) the status and condition of the population(s) or individual animals being affected; (2) seasonal timing of the disturbances; (3) value or quality of the disturbed sites; (4) physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover; (5) value or quality of adjacent habitats; (6) the type of surface disturbance; and (7) other variables that are difficult to quantify. As indicated in the Vernal RMP analysis, activities leading to direct vegetation loss would primarily include oil and gas development. Overall, ongoing and reasonably foreseeable oil and gas activities (e.g., construction of well pads, roads, and pipeline ROWs) would directly reduce the amount of available hiding and resting habitats, foraging and/or hunting habitats, and breeding, nesting and rearing habitats for a large variety of wildlife species.

Direct cumulative impacts from ongoing and reasonably foreseeable surface disturbing activities could also lead to mortality of small or slow-moving wildlife that are in the path of construction equipment or vehicles.

Special status wildlife species would also be cumulatively affected by RFD and the resulting direct impacts discussed above. However, on federal lands, surveys are generally required in suitable or occupied habitats of threatened, endangered or otherwise special status species. These surveys would help determine the presence of any special status wildlife species or its habitat, and protective measures would generally be taken to avoid or minimize direct disturbance in these critical areas.

Indirect cumulative impacts from ongoing activities and RFD would include (1) fragmentation or degradation (or functional habitat loss) of areas adjacent to direct disturbance; (2) decreased use of certain habitats through displacement of some wildlife species resulting in potential inter- and intra-species competition, and subsequent effects of deteriorated physical condition, reproductive failure, mortality, and general distress; (3) a decrease in reproductive success and nutritional condition from increased energy expenditure due to physical responses to disturbance; (4) an increase in the potential for collisions between bald eagles, big game, or slow-moving wildlife and motor vehicles because of increased traffic associated with RFD activities; and (5) an increase in the potential for poaching and harassment of wildlife because of increased human presence in the Vernal RMP area.

Based on these direct and indirect cumulative impacts, ongoing and RFD (including the GDBR project) in the Vernal RMP would cumulatively and incrementally reduce the productivity of wildlife habitats in the Vernal RMP area for the lifetime of oil and gas development and production (potentially 50 years or more).

5.3.7 Cultural Resources

Cultural resources are generally encountered during surveys before activities on federal lands. Additionally, more resources may be discovered during construction and subsequent operational activities. Short-term direct effects could occur during the discovery process if relevant cultural resource laws and guidelines are not followed. Potential long-term effects would involve the physical alteration or destruction of sites. Although it is not possible to totally avoid the potential for inadvertent destruction of sites, the planning process results in a relatively low rate for negative effects. Indirectly, the increased access resulting from new road construction for oil and gas activities would lead to vandalism and looting of newly discovered sites. Four types of activities would occur in the Vernal Resource Area that would result in the potential of either discovering cultural resources or inadvertently destroying them.

The Vernal RMP cultural resource analysis indicated that 4.87 sites/square mile may be in high density areas and 0.93 sites/square mile may be in low density areas. Based on this distribution of cultural sites, it was estimated that 96 sites may be discovered during oil and gas operations. Of the 96 potential sites, 70 could be in the Monument Butte area that contains the GDBR. By comparison, the analysis for the GDBR indicated that 7 to 22 sites would be discovered.

Rangeland improvement is another activity that could potentially lead to discoveries of cultural sites. Rangeland activities such as construction of fences, pipelines, and ponds on 935 acres could lead to a discovery of 7 sites based on an estimated site density in these areas of 2.9 sites/square mile.

A third activity with the potential for discovering cultural sites would be prescribed burning. BLM estimates prescribed burning would occur on 156,425 acres per decade. Because prescribed fires often occur at lower temperatures than wildfires, it is less likely that cultural sites would be damaged. At the same time, the reduction of ground cover can have an effect by uncovering sites that were previously obscured by vegetation. Furthermore, surveys would be conducted in areas with known high-density sites. Based on an average site density of 2.9 sites / square mile, there would be a possibility of finding 707 new sites in the 10-year burning period.

New and updated motorized and non-motorized trails would be a fourth venue for the discovery of cultural sites. Travel would be allowed in 300-foot buffers along these trails. Activities in these buffers could potentially result in a discovery of 481 sites. At the same time, there would be an increased chance of theft or vandalism of known and newly discovered sites as public access would increase along and near these trails.

The implementation of all these activities could potentially result in the discovery of 1,291 new sites. Although oil and gas activities would account for only 96 of these sites, the probability of discovering new sites on lands needed for oil and gas facilities would be the highest because of the site-specific cultural surveys that would be required.

5.3.8 Paleontology Resources

Cumulative impacts to paleontological resources of the CIAA would primarily result from activities associated with surface and subsurface disturbance associated with oil and gas development, recreational use/OHV travel, and fire management.

Oil and gas activities, including gas development in the CWSA, could have short- and long-term adverse cumulative effects on paleontological resources in the CIAA. Surface disturbance that results from oil and natural gas development could affect paleontological resources by damaging or destroying fossils. Adverse effects include physical damage to or destruction of fossils, as well as increased vandalism and theft that result from improved access to fossil localities. However, similar to cultural resources, site-specific paleontological surveys are generally required prior to oil and gas surface disturbing activities. When these surveys follow the procedures for assessment and mitigation found in the BLM Manual H-8270-1, Chapter III (1998b), they reduce or eliminate the potential for adverse impacts to fossil resources. Exploration for and development of mineral resources can also have a cumulative beneficial effect on paleontological resources by drawing the attention of a qualified paleontologist to areas that are not currently being researched, resulting in the collection of specimens and data that would not otherwise be recovered.

Because of the rich paleontological history of the Uinta Basin, paleontological resources are often one of the key issues addressed in NEPA documents for oil and gas development. Most of the existing field development NEPA documents listed in Table 5-1 include at least some discussion on paleontology and fossil resources. Many of the more recent NEPA documents outlined in Table 5-1 (i.e., Tabby Canyon Oil and Gas Field Development EA, Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS, West Brundage Canyon Oil and Gas Field Development EA, Chapita Wells/Stagecoach Area EIS, West Bonanza EA, Bonanza Area EA, Resource Development Group EIS, Sowers Canyon Oil and Natural Gas EA, Love Unit EA, Riverbend Natural Gas Drilling Project EA, LCU/HCU/BPU EA, and Gasco Development EIS) include detailed discussions on direct, indirect and cumulative impacts to fossils and paleontological resources.

5.3.9 Land Use

The potential for increased productivity and resulting economic viability that oil and gas resources in the CIAA provide would encourage mineral lessees to effectively develop and drain their leased resources. Consequently, potential cumulative impacts of the past, present and future activities (including the Proposed Action) on land use would involve a more prominent use of the CIAA for oil and gas development. Based on past, present and reasonably foreseeable surface disturbance estimates discussed in the Mineral Potential Report for the Vernal Planning Area, approximately 50,310 acres would be used for oil and gas development over the next 15 to 20 years, approximately 1,735 acres of which, or 3.4 percent of the cumulative surface disturbance, would occur in the CWSA.

City and county land use plans are anticipated to adjust according to the level of oil and gas development in the CIAA in order to accommodate anticipated community growth. In general, an increased level of development is expected to occur in areas adjacent to communities in the CIAA, resulting in a more urbanized local appearance. An increasingly aggressive oil and gas development scenario may result in land acquisitions to create or protect recreational or other opportunities in areas of the CIAA containing unique resources. These acquisitions could involve Federal lands, Indian trust lands, state lands, or privately owned lands. The potential for consolidating land ownership patterns could result in increased development in more remote areas, including recreational development.

The scope and depth of discussion on land use in the NEPA documents listed in Table 5-1 is highly variable. The more detailed accounts of land use and impacts to land uses are generally included in the EISs (e.g., Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS, Chapita Wells/Stagecoach Area EIS, Resource Development Group EIS) and EAs on Tribal/allotted lands (e.g., Tabby Canyon Oil and Gas Field Development EA, West Brundage Canyon Oil and Gas Field Development EA). Most of the remaining NEPA documents listed in Table 5-1 include or will likely include at least some discussion on land use, however, quantitative cumulative impacts analyses on this rather intangible issue are limited or non-existent.

5.3.10 Transportation

Cumulative impacts to transportation in the CIAA from would result from past, present, and reasonably foreseeable construction of roads to support a growing population, construction of roads to support increased mineral resource development, and designation of special resource-value roads and trails to support recreational opportunities. Adverse cumulative impacts would include increased traffic and increased potential for vehicular accidents. Beneficial impacts would include improved road surfaces which would facilitate increased vehicle use and access throughout the CIAA.

Extensive oil and gas development already exists in and near the CWSA and throughout most leased areas of the CIAA that have already seen oil and gas development. Road networks and traffic associated with developed oil and gas fields are already established. Additional oil and gas development in existing fields would primarily result in the construction of additional, short dead-end roads used to access well locations. As oil and gas development is extended into areas of the CIAA that have seen the development of only exploratory wells, arterial roads would be constructed, and the web of primarily dead-end well access roads would be constructed thereafter. Vehicle traffic to oil and gas locations would be the highest during construction, drilling, and completion operations and would substantially decrease once construction activities diminish and wells are put on production. Traffic to well locations would decrease as telemetry is installed by some operators to allow remote monitoring.

Construction of roads in rural areas would provide easier access for recreational users and OHV users. Hunters may be able to access more remote areas in the Book Cliffs to increase their opportunities for success. Hikers may be able to more easily access the canyons along the Green River. Use of roads constructed for oil and gas development by recreational users may result in conflicts or accidents as passenger vehicles are confronted with large trucks transporting water, chemicals, and/or heavy machinery.

Most roads in the CIAA are claimed by the counties as county roads. Increased use of roads by all users would result in increased maintenance obligations to ensure a safe running surface.

Discussions on transportation and transportation-related cumulative impacts are somewhat limited in the NEPA documents listed in **Table 5-1**. Similar to land use, more detailed accounts of transportation and transportation related impacts are generally included in the EISs (e.g., Castle Peak and Eight Mile Flat Oil and Gas Expansion Project EIS, Chapita Wells/Stagecoach Area EIS, Resource Development Group EIS). However, quantitative calculations of cumulative transportation-related impacts are not available.

5.3.11 Rangeland Resources

Cumulative impacts to livestock and grazing resources in the CIAA would primarily be caused by road and trail construction and maintenance, well pad and access road construction, vehicle traffic, accidental spills of potentially hazardous material, and noxious weed infestations primarily resulting from oil and gas development. Forage for livestock would continue to be removed from available use as oil and gas development continues to expand. AUMs directly relate to forage amounts needed to support one animal, either grazing animal or wildlife individual, for one month. A reduction in the amount of available forage, therefore, results in a reduction of the number of AUMs supportable by a particular allotment.

Livestock grazing is a permitted use of public lands. Although some minor changes may be expected over the next few years, it is reasonable to expect that livestock grazing will continue. Annual grazing potential within the Vernal Resource Area is predicted to be 138,987 AUMs for livestock, and 104,930 for wildlife. The AUMs under the Proposed Action would be 4,602, or 1.9 percent of the cumulative total. Oil and gas operations and other land uses would directly affect livestock and wildlife grazing by the removal of forage.

The development of roads has had, and will continue to have, both adverse and beneficial impacts on the livestock grazing activities and resources. Roads would beneficially provide additional access to portions of the allotments that currently do not have access. Roads also have the ability to increase livestock distribution in some areas, but can also disrupt distribution patterns. Increased livestock distribution could occur in some areas that have previously been inaccessible due to terrain limitations, distance from water, or a combination of both. Livestock distribution would be adversely disrupted in some areas because livestock would move along the road network, thereby missing available forage, or livestock could gain access to areas that are not desirable or are too fragile for grazing. Roads would also allow increased vehicular traffic, contributing to potentially adverse disturbance to livestock from OHV users and those seeking dispersed recreational opportunities.

5.3.12 Recreation

Cumulative impacts to recreational resources in the CIAA would be caused by oil and gas development, cultural and paleontological resource protection, fire management, construction and/or designation of roads and trails, mineral resource development, changes in recreational opportunities, designation of ACECs, and management actions taken by the Ashley National Forest and counties within the CIAA. Adverse impacts associated with these activities would mainly include short and long-term recreational closures, restrictions, and/or a diminished recreational experience due to the presence of noise and human activity. Continued promotion by the State of Utah of the Uinta Basin and vicinity as “Dinosaurland” could result in conflicts between tourism and oil and gas development in the more rural areas of the CIAA. BLM, National Forest, and county plans are anticipated to provide for the availability and quality of recreation in consideration of increasing oil and gas development in the CIAA. For people not negatively influenced by development and the presence of infrastructure, increased road surfaces in the CWSA would increase recreational access to the area.

Cumulative oil and gas activities, in general, are increasingly modifying the natural landscape through surface disturbance, construction and installation of facilities, pipelines and roads, and degradation of air quality resulting in visibility impairment, all of which could affect the quality of a recreational experience in particular areas where recreational opportunities are also available. The addition of 6,530 wells to an already highly developed oil and gas activity area would increase the existing impacts from such development. The addition of QEP’s proposed wells to existing and reasonably foreseeable oil and gas operations in the CIAA would have minimal cumulative impacts on recreational resources in the CIAA. As discussed in Section 4.12, potential impacts include temporary and long-term displacement of recreation opportunities in the CWSA. Short-term impacts would primarily occur during the initial construction and drilling phases of the project. Long-term impacts would occur as a result of people avoiding areas of human infrastructure.

The scope and depth of cumulative impact discussions for recreation in the NEPA documents listed in **Table 5-1** is dependent upon the level of recreational activity within each area-specific document. For example, where oil and gas development is proposed near the White River, the associated NEPA document tends to include rather detailed (albeit mainly qualitative) analyses of impacts to recreation (e.g., Chapita Wells/Stagecoach Area EIS, West Bonanza EA). Where development is proposed in areas with little recreational activity, the NEPA documents in **Table 5-1** devote little or no attention to the analysis of recreational impacts.

5.3.13 Visual Resources

The current management objective for visual resources in the CIAA is to manage the public lands in such a way as to preserve those scenic vistas that are deemed most important and to design or mitigate all visual intrusions so that the intrusions do not exceed the established VRM class objectives. Activities within the CIAA that could potentially cause visual intrusions and have an impact on scenic quality are primarily surface-disturbing activities, including minerals exploration and development, OHV use, trail and/or road development, and fire management. Generally, the greater the degree of surface disturbance, the greater the impact would be to scenic quality.

Oil and gas activities are the predominant source of modification to the landscape and visual environment of rural areas of the CIAA in the Uinta Basin. Past, present, and future oil and gas development in the CIAA would have both direct and indirect impacts on visual quality. The cumulative effects on visual quality would include strong visual contrasts from (and not limited to) the construction of well pads, access roads, drilling rigs, pipelines, and processing and support facilities. Indirect impacts to visual quality, both short-term and long-term, would occur as a result of soil erosion from disturbed areas, fugitive dust from disturbed areas, and/or regional haze from compressor and generator emissions that could obscure or degrade scenic vistas.

Oil and gas activities would be required to conform to the VRM Class Objectives in visually sensitive areas, Class III VRM and higher. Therefore, a cumulative visual deterioration would not occur because mitigation would be applied as necessary. Such measures would include:

- Repeat elements of form, line, color, and texture;
- Repeat landscape color and shade;
- Paint all facilities on pad same color;
- Repeat landscape lines by following contours;
- Avoid ridge lines and hill tops to avoid skylining;
- Install low structures;
- Bury utility lines, pipelines, and flow lines in visually sensitive areas;
- When a new road is created to replace an existing one, reclaim and revegetate the old road;
- Avoid locating roads on steep slopes;
- Where possible, avoid large pads on steep slopes; and
- Apply interim reclamation as soon as possible.

5.3.14 Socioeconomics

The economy of Uintah and Duchesne Counties are largely driven by the oil and gas industry. Therefore, this cumulative economic analysis has the emphasis on the oil and gas industry. Other minor actions related to recreation and rangeland management may have a small effect but would be much less than the oil and gas industry.

The GDBR would constitute about 23 percent of gas wells and 5 percent of oil wells predicted in the Vernal Resource Area. Based on QEP's estimates of mineral withdrawals for a 30-year life of production for each well, QEP royalties would amount to $140.1 million to the State of Utah and $26.2 million to Uintah County. Applying the assumption that similar mineral withdrawal rates would be applicable for the RFD wells, and all of the RFD wells would be federal minerals, $1.009 billion in royalties would be paid to the State of Utah. Wells in Uintah and Duchesne Counties are assumed to be equally distributed so each county would receive $79.5 million. In addition, local agencies and governments would be eligible to apply for a portion of the $327.9 million in PCIF funding.

Job creation for the RFD is predicted to be 211,369 over the initial 20-year period for an average of 10,568 per year. Job creation for QEP is predicted to be 311 per year for the first 10 years and then decrease to 61 per year afterwards to operate the field.

5.3.15 Noise

Noise sources associated with oil and gas activities would occur 1) near construction, drilling, and completion of wells; 2) near compressor stations; and 3) along access roads where project-related vehicles would travel to sites. Cumulative noise effects from oil and gas activities would be minor because there would be sufficient distance between project construction sites and operational compressor stations, as well as sufficient distance between activities in adjacent fields. Noise would increase along major thoroughfares within the Vernal Resource Area that would provide access to oil and gas activities.

5.3.16 Health and Safety

Potential cumulative effects to human health and safety that could be associated with oil and gas development in the CIAA include:

- Occupational accidents that could be experienced by project workers;
- An increase in traffic hazards and accidents on public roads;
- Pipeline hazards and potential for accidental rupture or damage of pipelines by heavy equipment; and
- Effects to health and safety related to the use of hazardous materials and accidental spills or releases of hazardous materials.

In general, compliance with 43 CFR Ch. II, subpart 3162.5, and other regulations related to health and safety and environmental protection would minimize risks to human health and safety. The following is a discussion of health and safety impact issues identified as concerns in the CIAA. In general, to reduce the risk and seriousness of accidents and injuries to workers and the public, operators would be required to develop drilling and operations plans that would cover all potential emergencies, including fires, employee injuries, and chemical releases, among others as mentioned above.

<u>Occupational Hazards</u>

Statistical data on occupational accidents and fatalities for the oil and gas extraction labor category are available from the U.S. Bureau of Labor Statistics. Nationwide, the oil and gas industry experienced an accident rate of 3.2 accidents per 100 full-time workers and 23.1 fatalities per 100,000 workers in 2001 (U.S. Bureau of Labor Statistics 2003). As shown in Section 5.3.14, it is estimated that job creation for the CIAA is predicted to be 211,369 over the initial 20-year period for an average of 10,568 per year. Based on this employment rate, it is statistically probable that about 338 occupational accidents would occur each year. Similarly, based on the national rate for fatal accidents in the industry, there is about a 11 percent chance of one fatality occurring each year. The number of occupational accidents would likely be higher during the earlier years of the project where construction activity and employment would be more intensive. Following the completion of all construction and drilling in the later years of the project, employment would be reduced and the number of occupational accidents is expected to decline. Compliance of the operators with applicable safety regulations would reduce the probability of occupational accidents.

<u>Increased Vehicular Traffic</u>

Development would result in an increase in traffic on roads in the CIAA, along with proportionate increases in the risk of traffic accidents. With compliance with recommended speed limits on county roads, the risk of additional accidents is expected to be low and the resulting health and safety impact would be minor.

Pipeline Hazards

Oil and gas development would increase the potential for leaks or ruptures of gas pipelines. Most ruptures occur when heavy equipment accidentally strikes a buried pipeline while operating in close proximity. These ruptures may result in a fire or explosion if a spark or open flame ignites the escaping gas. Safety statistics are complied only for buried oil and gas pipelines. Therefore, the safety risk factors can only be inferred for surface lines. Based on the RFD, approximately 1,405 miles of new oil and gas pipelines would be installed (see Table 5-2 where 5,111 acres disturbance is predicted for pipelines which results in 1,405 miles assuming 30-foot ROW). Based on the statistical average of one safety incident per year per 4,035 miles of total pipeline (OPS 2003), seven additional pipeline safety incidents (including ruptures) are statistically probable over the next 20 years. Given the relatively low risk of potential pipeline accidents in the CIAA , and its relatively rural character, the risk to public health and safety from pipeline hazards would be minor. The risk would be minimized by the design of pipelines in accordance with applicable standards to minimize the potential for a leak or rupture. Pipeline markers would be posted where above ground pipelines cross roads. Operators would monitor the pipeline flows by either remote sensors or daily inspections of the flow meters. Routine monitoring would reduce the probability of effects to health and safety from ruptures by facilitating the prompt detection of leaks. If pressure losses were detected, the wells would be shut in until the problem is isolated and addressed.

Use of Hazardous Materials, Pesticides, and Accidental Spills and Releases of Hazardous Substances

Petroleum, natural gas, natural gas liquids or condensates, and produced water could all contain regulated hazardous substances, such as benzene, hexane, various polynuclear aromatic hydrocarbons (PAHs), heavy metals, and other compounds. Construction and drilling equipment would require gasoline and diesel fuels, lubricants, and coolant to operate. Drilling and fracturing fluids, which include some hazardous additives or constituents, would also be required. Disposal of some quantities of crude oil or condensate typically involves the sale of these wastes to a waste oil recycler. Contaminated soils are generally disposed of in an approved landfill used for non-hazardous wastes or are treated on site (through land farming or aeration) if permitted by the local regulatory agencies.

Federal and State of Utah regulations address the transport, storage, and disposal of hazardous materials or wastes. Assuming that QEP complies with the regulations, these rules would minimize the potential for spills or contamination of surface drainages or groundwater or releases of air emissions. Regulations for handling, storage, and disposal of hazardous materials are codified at 49 CFR Parts 171 and 179. EPA requires a Spill Prevention Control and Countermeasures Plan (SPCC) under 40 CFR Part 112 for storage of large quantities of petroleum products, such as fuels. Oil spills must be reported to the EPA National Response Center as required by 40 CFR Part 110. Federal and state operating and reporting requirements include provisions to clean up and mitigate spills or releases of chemicals, product, or wastes.

Human health and safety would likely be protected through compliance by operators with all applicable federal and state laws concerning safe operation of oil and gas facilities. In addition, as mentioned previously, operators would develop emergency response plans and employee-training programs that address spill prevention and control measures for hazardous materials and wastes. Accordingly, impacts to human health and safety from hazardous materials, pesticides, and wastes typically associated with oil and gas development are expected to be negligible.